P30-454

CT based patient-specific cutting blocks for total knee arthroplasty: technique and preliminary radiological results

P.P. Koch[1], *D.A. Müller*[1], *S.F. Fucentese*[1]
[1]University of Zurich, Orthopaedic Department, Zurich, Switzerland

Objectives: Accuracy in component positioning for total knee arthroplasty (TKA) remains a major concern. Many studies show that computer-assisted surgery (CAS) improves the precision significantly compared with standard manual techniques. However, computer navigation has limitations such as investment costs, longer operation time and additional complication risks. In the last 2 years, the technology of polyamide laser sintering to create patient-specific orientation tools according to preoperative CT-or MRI-data has been emerging. We present our experience with the MyKnee® technique (Medacta® International SA), which combines the guidance and cutting block in one.
Methods: Consecutive data of 70 patients were preoperatively sampled and prospectively analized for radiological precision of component implantation. With the CT scan a tridimensional bone model of the patient's knee with its hip-knee-ankle axis is created. This bone modeling acts as the base creating the anatomical cutting blocks that can fit a patient's knee morphology. The surgeon can plan his preferred landmarks and define the implant size, resection levels, femoral rotation and the amount of tibial posterior slope. After a standard surgical approach the cutting blocks are mounted to the tibial plateau and the distal femur, adapted to unambiguous bony landmarks. The cuts are performed directly through that block. Further surgical steps are following according standard techniques. Pre- and post-operative long-standing X-ray were available for analysis, planned and implanted component size were compared.
Results: The postoperative mechanical axis were between 4.5° of valgus and 3.1° of varus, including 7 outliers (deviation > 3° from neutral or planning, corresponding 10%). Posterior tibial slope varied between 0° and 10° (15 outliers, 21.4%), comparing the first 35 cases (25.7% outliers) with the second 35 cases (17.1% outliers) a clear improvement was found. Femoral component flexion ranged between 0.2° and 6.4° (8 outliers, 11.4%). Compared to the planning 7 out of 140 components (5%) had to be changed in the size, 6 on the tibial side and two on the femoral side.
Conclusions: Compared to literature the radiological results of component implantation with patient matched instrumentation are comparable to the most precise technique of CAS TKA. The number of outliers are similar in all measured component positions, but more data will be needed to define significance. Our preliminary experience indicates that the MyKnee® technology of CT-based patient-specific cutting blocks represents a reliable, efficient and precise technique.

P30-523

A new spacer-guided PCL balancing technique results into good kinematics of an anatomically designed cruciate-retaining total knee arthroplasty

P. Heesterbeek[1], *L. Labey*[2], *P. Wong*[2], *B. Innocenti*[2], *A. Wymenga*[3]
[1]Sint Maartenskliniek, RD&E, Nijmegen, The Netherlands, [2]Smith & Nephew, European Centre for Knee Research, Leuven, Belgium, [3]Sint Maartenskliniek, Orthopedic Surgery, Knee Reconstruction Unit, Nijmegen, The Netherlands

Objectives: After total knee arthroplasty (TKA) with a PCL-retaining implant the location of the tibiofemoral contact point (CP) should be restored in order to obtain normal kinematics. The difficulty during surgery is to control this location since the position of the femur on the tibia cannot easily be measured from the back of the joint. Therefore, we developed a simple "spacer technique" to check the CP indirectly in 90° flexion after all bone cuts are made by measuring the step-off between the distal cut of the femur and the anterior edge of the tibia with a spacer in place. The goal of this experiment was to investigate whether this new PCL balancing approach with the spacer technique created the correct CP location.
Methods: Nine fresh-frozen full leg cadaver specimens were used. After native testing, prototype components of a new PCL-retaining implant were implanted using navigation and a bone-referenced technique. After finishing the bone cuts of tibia and femur, the spacer was inserted in flexion and positioned on the anterior edge of the bony surface to measure the step-off. If necessary, an extra cut was made to correct the step-off and thus balance the PCL.
The specimen was mounted on the knee kinematics rig and a squat with constant vertical ankle force (130 N) and constant medial and lateral hamstrings forces (50 N) was performed between 30° and 130° of knee flexion. The trajectories of the reflective tibial and femoral markers were continuously recorded using six infrared cameras. CP (native and implant) were calculated as the projections of the femoral condylar centers on the horizontal plane of the tibia.
Results: Of the 9 specimens, the calculated step-off was correct in 7 after finishing the bone cuts and in 2 specimens an additional tibia cut with 2°–3° more slope was sufficient to achieve the correct step-off. No lift-off of the tibial tray occurred during the tests. The patterns of the kinematics of the native and replaced knee showed quite good similarity. The medial CP of the knee implant is at the same position as the medial CP of the native knee. No paradoxical roll forward is seen in the knee implants, showing that the PCL balancing apparently seems to work quite well. The lateral CP of the knee has a similar kinematic pattern in flexion before and after TKA. The CP of the implant shows a slightly more anterior location near extension but this is only marginal.
Conclusions: The kinematics of the PCL-retaining implant are on average comparable to the kinematic pattern of the native knee. Apparently, the joint surfaces of the anatomic knee designed with a dished medial insert surface and a convex lateral insert surface and a 3° varus of the joint line is guiding the motion towards that of a normal knee joint. We feel that correct balancing of the PCL during implantation is of major importance in achieving these results. The spacer technique to balance the PCL seems to work well in this experiment.

P30-576

A novel reference axis that indicates axial alignment of distal tibia in total knee arthroplasty

H. Enomoto[1], *T. Nakamura*[2], *H. Shimosawa*[1], *Y. Niki*[1], *Y. Toyama*[1], *Y. Suda*[1]
[1]Keio University, Department of Orthopaedic Surgery, Tokyo, Japan, [2]Johnson & Johnson Japan, Tokyo, Japan

Objectives: Appropriate alignment is essential for successful clinical outcome and the implant longevity after TKA. In proximal tibial osteotomy with an extra-medullary guide, we usually set the instrument with reference to tibial tuberosity proximally and 1st or 2nd metatarsus distally. However, especially in case of ankle deformity, we occasionally feel dilemma how to align the instrument distally, considering the metatarsus and/or trans-malleolar axis. Here we introduce a novel reference axis indicating axial rotation, which we defined specifically for this study.
Methods: 3D-CAD models of 20 tibiae from OA patients (73.8 ± 6.9 y/o) were reconstructed from CT data using Mimics (Materialise).
Tibial Coordinate System; Our system is mid-sagittal plane based algorithm defined by an apex of the tibial plafond, PCL enthesis, and tibial tubercle. The origin was projected midpoint of bilateral eminences on the sagittal plane. Then the Z (vertical) axis was defined as the line between the origin and the apex of the tibial plafond. The normal vector of the sagittal plane was assigned as the Y axis (ML).